

New Ants of the Australasian Genus *Orectognathus*, with a Key to the Known Species (Hymenoptera: Formicidae)

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Abstract

Seven species of *Orectognathus* (= *Arnoldidris*) are described as new (*O. darlingtoni*, *O. nanus* and *O. parvispinus* from north-east Queensland; *O. robustus* from eastern Queensland; *O. elegantulus* from south-east Queensland; *O. roomi* and *O. velutinus* from south-east New Guinea), along with notes on some older species, discussion of their likely relationships, and a key to workers of the 26 species now known. Workers of most species are illustrated, chiefly with scanning electron micrographs, and the holdings of the Australian National Insect Collection are briefly reviewed.

Introduction

This paper provides a general review and a comprehensive key to species of the Australasian dacetine ant genus *Orectognathus* Frederick Smith, 1853 (= *Arnoldidris* Brown, 1950; synonymy by Brown 1973). The genus has been adequately defined by Brown (1953). It may be minimally diagnosed as follows: *myrmicine ants of tribe Dacetini, long mandibulate, with five antennal segments*. No other known Australian or Melanesian ants have five-segmented antennae, apart from several undescribed *Colobostruma* species from eastern Queensland which are represented in the Australian National Insect Collection. *Orectognathus* has been classified in the subtribe *Orectognathiti*, setting it apart from all other middle-ranking dacetine ants, which are assigned to subtribe *Epopostrumiti*. The latter taxon comprises the Australia-based genera *Epopostruma*, *Mesostruma* and *Colobostruma* (Taylor 1973), along with the African genus *Microdaceton*, which includes the only known ants apparently closely related to the above genera and found beyond Australia, Melanesia or New Zealand. *Microdaceton* has been placed previously in the *Epopostrumiti*. However, it strongly resembles *Orectognathus*, a fact which might require changes in the classification summarized above (see p. 603).

The present work is intended basically as a guide to identification of relevant worker specimens, not as a full-scale systematic and biological review. Five Australian and two New Guinean species are described as new, bringing the tally of known *Orectognathus* species to 26. Eleven of these are Melanesian (10 New Guinean, one New Caledonian) and 15 occur in eastern Australia, including one apparently endemic to Lord Howe I. One Australian species is found also on the North Island of New Zealand. *Orectognathus* evidently has about average species representation among the approximately 100 ant genera present on the Australian continent.

Sexual females and males are discussed only briefly here, though notice of the existence of specimens is given whenever appropriate; they can be easily retrieved in future when required. Study of sexuals will doubtless contribute to better understanding of classification and affinities among the species of *Orectognathus* and related genera. However, currently collected material, especially of males, is insufficiently representative to provide really meaningful data in this context.

Relevant previous taxonomic publications are listed in two recent papers (Lowery 1967; Taylor and Lowery 1972). The illustrations given here are specifically intended to supplement those published in these references and in the review of Brown (1957), so that workers of all Australian and most New Guinean species have been the subjects of adequate figures or scanning micrographs published since 1957. Most illustrations are based upon specimens from the Australian National Insect Collection.

The plates are micrographs prepared by the author with a J.E.O.L. JSM U3 scanning electron microscope, using gold-palladium coated specimens. The photographic prints and line illustrations (which are based on camera lucida drawings) were prepared by Rudolf Kohout.

Abbreviations and details of measurements and indices used below are those of Brown (1953), with some additions as prescribed by Taylor and Lowery (1972). TL is aggregate total length and scape index (SI) is scape length (SL) \times 100/head width (HW). Measurements are given in millimetres, and were made by use of an eyepiece ruler reading directly to 0.01 mm at \times 100 magnification.

The following abbreviations are used for institutions:

AM	Australian Museum, Sydney
ANIC	Australian National Insect Collection, CSIRO, Canberra
BM(NH)	British Museum (Natural History), London
GM	Museum d'Histoire Naturelle, Geneva, Switzerland
HNM	Hungarian Natural History Museum, Budapest
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Mass.
MNB	Museum für Naturkunde, Humboldt-Universität, Berlin
QM	Queensland Museum, Brisbane
SAM	South Australian Museum, Adelaide

Synopsis of *Orectognathus* Species

This list includes only senior synonyms. Further details, with full synonymy and references, can be obtained for species published before 1953 in Brown's revision of the genus (1953), and for later species in Brown (1957), Lowery (1967) and Taylor and Lowery (1972).

Group of *O. sexspinosus*

- O. nigriiventris* Mercovich, 1958, p. 195, figs 1a, 1b (eastern New South Wales).
- O. phyllabates* Brown, 1957, p. 25, fig. 4 (south-east Queensland; north-east New South Wales).
- O. elegantulus* Taylor, sp. nov. (south-east Queensland; north-east New South Wales).
- O. sexspinosus* Forel, 1915, p. 39, pl. 2, figs 1, 2 (north-east Queensland).

Group of *O. versicolor*

- O. clarki* Brown, 1953, p. 94, figs 1b, 2c (Tasmania; South Australia, Flinders Ranges; Victoria; north through New South Wales to mountains of south-east Queensland).
- O. versicolor* Donisthorpe, 1940, p. 46 (eastern New South Wales, south-east and central eastern Queensland).

Group of *O. czikii*

- O. czikii* Szabó, 1926, p. 350, figs A, a (New Guinea).
O. echinus Taylor & Lowery, 1972, p. 310, pl. 2 (New Guinea).

Group of *O. hystrix*

- O. hystrix* Taylor & Lowery, 1972, p. 307, pl. 1 (New Guinea).
O. roomi Taylor, sp. nov. (New Guinea).

Group of *O. antennatus*

- O. mjobergi* Forel, 1915, p. 38, pl. 2, figs 3, 4 (eastern Queensland, north-east New South Wales).
O. antennatus Fred. Smith, 1853, p. 228, pl. 21, fig. 9 (south-east Australia; North Island, New Zealand).
O. sarasini Emery, 1914, p. 416 (New Caledonia).
O. howensis Wheeler, 1927, p. 145, fig. 7 (Lord Howe I.).
O. darlingtoni Taylor, sp. nov. (north-east Queensland).
O. satan Brown, 1953, p. 102, fig. 3 (north-east Queensland).

Group of *O. rostratus*

- O. robustus* Taylor, sp. nov. (eastern Queensland).
O. parvispinus Taylor, sp. nov. (central eastern Queensland).
O. nanus Taylor, sp. nov. (north-east Queensland).
O. rostratus Lowery, 1967, p. 137, figs 1, 2 (south-east Queensland; north-east New South Wales).

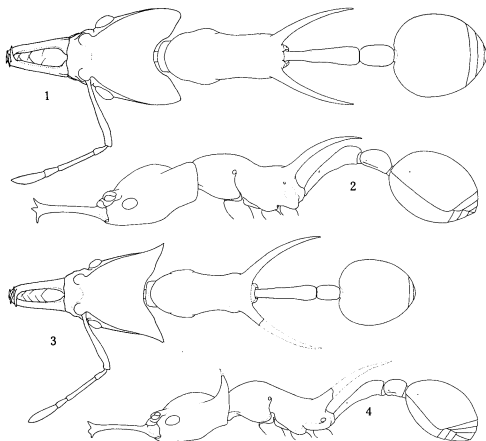
Group of *O. chyzeri* (all are New Guinean species)

- O. horvathi* Szabó, 1926, p. 349, figs C, c.
O. velutinus Taylor, sp. nov.
O. chyzeri Emery, 1897, p. 571, pl. 14, figs 1, 2.
O. biroi Szabó, 1926, p. 351, figs B, b.
O. szentivanyi (Brown), 1957, p. 18, figs 1, 2 (comb. nov. ex *Arnoldidris*).
O. longispinosus Donisthorpe, 1941, p. 58.

Holdings of the Australian National Insect Collection

Although a detailed systematic study of *Orectognathus* is not attempted here, the ANIC now contains material which could contribute importantly to this task. All known species are represented by worker specimens, many of them extensively, and most by type material. This includes: syntypes of both valid species described by A. Forel, and of *O. czikii*; holotypes (usually with paratypes) of all species described by B. B. Lowery, R. W. Taylor, Taylor and Lowery, and W. M. Wheeler, along with *O. clarki* and *O. phyllobates*; and paratypes of *O. satan*, *O. nigriventris* and *O. szentivanyi*. The only Australian species not represented by type material are *O. antennatus* (with its junior synonym *septentrionalis* Forel) and *O. versicolor*. In addition the ANIC has worker-associated specimens of queens (some paratypes) of *antennatus*, *clarki*, *darlingtoni*, *echinus*, *elegantulus*, *howensis*, *mjobergi*, *nanus*, *nigriventris*, *parvispinus*, *robustus*, *rostratus*, *satan* and *versicolor*; while *clarki*, *hystrix*, *nanus*, *robustus*, *satan* and *versicolor* are represented by worker-associated males. There is also much duplicate spirit-preserved material, with colony series collected to comprise all brood stages originally present, including unstudied larvae of several species; along with voucher specimens from chromosomal and other studies (e.g. Crozier 1968). Material generously donated by the Rev. B. B. Lowery, S.J., has greatly enhanced the ANIC as the primary, though still rudimentary, bank of specimens and data pertaining to the Australian ant fauna.

Some of the type material discussed above has been added recently to the ANIC by gift or exchange from other institutions. These include GM, HNM, MCZ and SAM. The generosity of the Directors, Governing Boards and Entomologists of these museums is gratefully acknowledged. Special thanks are due to Dr C. Besuchet (GM), Drs L. Móczár and J. Papp (HNM), Dr W. L. Brown Jr. (MCZ) and Mr. G. F. Gross (SAM). As a result of their actions future confidence in identifying *Orectognathus* specimens, using the ANIC for reference, has been maximized. Also, any future nomenclatorial problems involving these ants should be readily resolved.



Figs 1-4. Standard views of *Orectognathus* workers, *chyzeri* group: 1, 2, *O. biroi*, holotype (HW 1.22 mm); 3, 4, *O. horvathi*, syntype (HW 1.06 mm).

The following transfers of holotype specimens to the ANIC are here formally reported. The specimens have been labelled appropriately.

- (1) *Orectognathus antennatus* var. *howensis* Wheeler, 1927, *Proc. Am. Acad. Arts Sci.*, 62, pp. 145-6, fig. 7. Unique holotype transferred 25.vi.1973 from SAM to ANIC (Type No. 7518).
- (2) *Orectognathus phyllobates* Brown, 1957, *Psyche J. Entomol.*, 64, pp. 25-7, fig. 4. Unique holotype transferred 1.vii.1974 from MCZ to ANIC (Type No. 7519).

Paratype specimens of as many as possible of the species described here have been deposited in appropriate Australian State museums, and in the leading British, European and North American ant collections.

Notes on some Previously Described Species

The following notes bring up to date the information available on several New Guinean species previously included in *Arnoldidris*.

Orectognathus biroi Szabó

(Figs 1, 2)

Two workers (ANIC) collected in 1970 by Rev. B. B. Lowery closely match the unique holotype (HNM), which is the specimen illustrated here. They are from Bulolo, Morobe district, New Guinea, a locality about 140 km south-west of the type locality, Sattelberg, near Finschhafen, on the Huon Peninsula. Both collections were probably made at elevations near 600 m, and it is notable that the two sites are on different mountain blocks, separated by much lower elevations along the Ramu and Markham River valleys. *O. biroi* has also been reported from Wamuki on the Huon Peninsula (Brown 1957).

These specimens have the following dimensions (holotype cited first): TL c. 6·2, 6·4, 6·0; HL (max.) 1·43, 1·43, 1·46; HL (mid) 1·08, 1·05, 1·08; HW 1·22, 1·20, 1·26; CI 85, 84, 86; SL 0·90, 0·87, 0·90; SI 74, 73, 71; ML 0·70, 0·70, 0·73; MI 49, 49, 50; ThL 1·62, 1·56, 1·64; PL 0·88, 0·82, 0·88; width of pronotum in dorsal view 0·70, 0·64, 0·67; chord length of propodeal spine 1·04, 1·02, 1·04; length of postpetiole in dorsal view 0·40, 0·37, 0·40.

Orectognathus horvathi Szabó

(Figs 3, 4)

I have studied two syntype specimens (HNM), one is intact and the other has the head detached but carded upside down with its other remains. The first specimen is illustrated here.

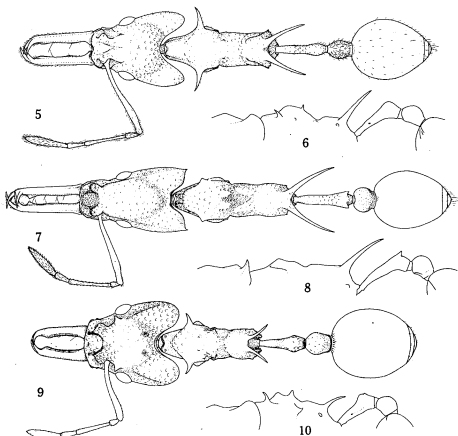
The following dimensions are complete only for the intact individual: TL c. 5·3, 5·4; HL (max.) 1·14; HL (mid) 0·98; HW 1·06, 1·16; CI 93; SL 0·78; SI 74; ML 0·69; MI 61; ThL 1·48, 1·54; PL 0·72, 0·78; width of pronotum in dorsal view 0·60, 0·64; chord length of propodeal spine 1·08, 1·16; length of postpetiole in dorsal view 0·30, 0·32. In these measurements the end-points for HL and HW are based on the outline of the occipital lobes proper, excluding their apical 'horns'; otherwise the various indices involving these dimensions would not be comparable with those published for other species.

O. horvathi has been considered 'possibly the most bizarre formicid known' (Brown 1957), a status it no longer enjoys, even among New Guinea *Orectognathus*, which include such spectacular species as *O. echinus*, *O. hystrix* and especially *O. roomi* (Figs 24–26).

Key to the Species of *Orectognathus* (Workers)

1. *a* Australian, New Guinean, New Caledonian or New Zealand species with pronotal humeri distinctly spinose, dentate or tuberculate (Figs 5, 7); promesonotal dorsum sometimes continuously convex and unarmed (Figs 14, 20), but more usually the pronotum is depressed and horizontal and the mesonotum, which may be dorsally inflated, is armed with 1 or 2 pairs of tubercles, welts or small teeth (Figs 8, 10, 24).....2
- b* New Guinean species with pronotal humeri gently rounded, lacking all trace of spines or tubercles; promesonotal dorsum continuously convex, completely unarmed (Figs 1, 2).....21

- 2(1). *a* Petiolar node rounded in general outline, completely lacking dorsolateral spines, denticles or other armament (Figs 5, 14) (in addition the body and limbs sometimes bear abundant, generally distributed, fine, short erect pilosity as in Fig. 20).....3
b Petiolar node *either* armed with a pair of prominent dorsolateral spines or teeth (Figs 7, 24) or more or less prismatic in form, with an obtuse transverse crest bearing, usually distinct, dorsolateral denticles or angles (Figs 9, 34) (no known species of the latter group has generally distributed pilosity as described above).....8
- 3(2). *a* Outline of thoracic dorsum, in side view, complex; mesonotal section inflated, raised above pronotum and bearing a pair of erect dorsolateral spines or teeth, which supplement those of the pronotal humeri and propodeum (Fig. 6).....4
b Thoracic outline less complex, promesonotal profile evenly curved; no trace of mesonotal spines, though those of pronotum and propodeum are distinctly developed (Fig. 14).....5



Figs 5-10. Standard views of *Orectognathus* workers: 5, 6, *O. sexspinosus*, syntype (HW 1.14 mm); 7, 8, *O. satan*, paratype (HW 0.87 mm); 9, 10, *O. clarki*, holotype (HW 0.96 mm).

- 4(3). *a* Scapes reaching or minutely exceeding apices of occipital lobes when laid back along head; length of humeral spines slightly exceeding maximum eye diameter; propodeal spines about $3\times$ as long as the distance between the centres of their bases (Figs 5, 6). NE. Qld.....*O. sexspinosus* Forel
b Scapes, when laid back, clearly failing to reach occipital lobes by several times their maximum thickness; length of humeral spines only about $\frac{1}{2}$ maximum eye diameter; propodeal spines only $1.5\times$ as long as the distance between the centres of their bases (Figs 11-13). SE. Qld, NE. N.S.W.....*O. elegantulus*, sp. nov.

- 5(3). *a* Body and limbs almost totally lacking erect pilosity; mandibles approximately parallel when closed; inner border of each mandible, just basad of apical teeth, with a small tooth or dentiform angle (Fig. 15). E. Qld.....6
b Body and limbs with abundant, generally distributed, fine short pilosity; mandibles converging apically when closed, their inner borders lacking any trace of dentiform angles basad of apical teeth (Fig. 21).....7
- 6(5). *a* Propodeal spines elongate, approximately as long as the distance between the centres of their bases (Figs 14–16). E. Qld.....*O. robustus*, sp. nov.
b Propodeal spines reduced to small teeth, maximally (in larger specimens) about $\frac{1}{2}$ as long as the distance separating the centres of their bases, and barely larger than the anteocular teeth (in very small specimens the propodeal teeth may be represented only by a pair of low, narrow longitudinal welts) (Figs 17–19). Central E. Qld.....*O. parvispinus*, sp. nov.
- 7(6). *a* Occipital lobes and frons behind anteocular teeth bearing scattered foveae spaced on average at nearly $1.5 \times$ their average diameter, nearest neighbours only very rarely separated by less than $\frac{1}{2}$ their average diameter (Fig. 23); postpetiolar dorsum generally smooth, at best with only feeble traces of puncturation. S.E. Qld, NE. N.S.W....*O. rostratus* Lowery
b Foveae of frons and occipital lobes more dense, average separation only about $\frac{1}{2}$ their average diameter, nearest neighbours often separated by mere ridges, less than $\frac{1}{2}$ their average diameter (Fig. 21); postpetiolar dorsum with distinct foveate punctures. NE. Qld.....*O. nanus*, sp. nov.
- 8(2). *a* Centre of vertex with a pair of acute, erect teeth, approximately equal in size to anteocular teeth.....9
b Centre of vertex lacking acute teeth, though often inflated, and sometimes longitudinally bilaterally tumose or ridged.....10
- 9(8). *a* Head very narrow (CI 56–62); occipital emargination exceptionally deep, with its sides appearing almost parallel (in fact enclosing angles of c. $14-20^\circ$); humeral spines almost as long as propodeals and raised laterally above plane of pronotal dorsum at angles of c. 45° (Taylor and Lowery 1972, pl. 2). New Guinea.....*O. echinus* Taylor & Lowery
b Head broader (CI 84 in only available specimen); occipital emargination less deep, its sides enclosing an angle of nearly 65° ; humeral spines only about $\frac{1}{2}$ as long as propodeals and extending almost horizontally from sides of pronotal dorsum (Taylor and Lowery 1972, figs 1, 2). New Guinea.....*O. csikii* Szabó
- 10(8). *a* Occipital lobes each with a frontally directed tooth or spine which is either drawn out from the apex of the lobe (Figs 7, 8) or stands more or less free on its anterior face (Figs 24–26).....11
b Occipital lobes bluntly rounded posteriorly and lacking any trace of frontally directed teeth or spines (Figs 9, 10).....13
- 11(10). *a* Thoracic armament as in Figs 7, 8; pronotal humeri bearing very reduced blunt tubercles; mesonotum swollen, but lacking distinct spines; propodeal spines well developed. NE. Qld.....*O. satan* Brown
b Thoracic armament as in Figs 24–26; pronotal humeri, mesonotum and propodeum all with exceptionally developed, long acute spines. New Guinea.....12
- 12(11). *a* Body and appendages subopaque to opaque due to microsculpture; head, thorax and petiole very finely and regularly micro-reticulate; traces of similar but obscure sculpture on mandibles, scapes, legs, postpetiole and gaster (Figs 24–27).....*O. roomi*, sp. nov.
b Body and appendages almost entirely smooth and shining; sculpture consisting of a few vestigial foveate punctures on head (Fig. 28), more especially ventrally (Taylor and Lowery 1972, pl. 1).....*O. hystrix* Taylor & Lowery
- 13(10). *a* Anteocular teeth developed and normally strong, their apices acute or at least right-angled; head averaging broader, CI 79–97, only rarely less than 81.....14
b Anteocular teeth lacking or represented only by an obtuse angle on each frontal carina; head narrower, CI normally 67–80.....17
- 14(13). *a* Dorsal surface of head smooth and shining, with minute punctures or small, spaced foveae; dorsal surface of gaster with a fine but distinct more or less reclinate, pubescence-like pilosity.....15

- b* Dorsal surface of head covered with coarse, crowded and often contiguous foveae, the integument consequently subopaque to opaque; dorsal surface of gaster with only an extremely fine and sparse, appressed, pubescence-like pilosity (workers more or less polymorphic) 16
- 15(14). *a* Dorsal surface of head smooth and shining, with only the most minute and inconspicuous of punctulae; postpetiole about $1.5 \times$ as broad as long, broader anteriorly than behind (Brown 1957, fig. 4). SE. Qld, NE. N.S.W. *O. phyllobates* Brown
- b* Dorsal surface of head smooth and shining, but sown with numerous circular, umbilicate foveae; postpetiole only slightly broader than long, with convex sides, not or scarcely broader in front than behind (Brown 1957, fig. 3). E. N.S.W. *O. nigriiventris* Mercovich
- 16(15). *a* Inner mandibular borders shallowly but distinctly concave along basal two-thirds (Fig. 9); worker polymorphism not extending to an extreme large-headed, broad-jawed soldier form. Tas., S.A. (Flinders Ranges), Vic., N.S.W., S.E. Qld (mountains) *O. clarki* Brown
- b* Inner mandibular borders approximately straight along basal two-thirds (Fig. 43); polymorphism of workers extending to a very large-headed, broad-jawed soldier form (Fig. 45) in addition to more 'normal' minor workers (Fig. 43). E. N.S.W., SE. Qld. *O. versicolor* Donisthorpe
- 17(13). *a* Inner mandibular border just basad of apical teeth with a small dentiform angle, acute to subacute at tip (Fig. 46). Lord Howe I. *O. howensis* Wheeler
- b* Inner mandibular border without an acute or subacute toothlike angle in the region just basad of the apical teeth, though some species have a rounded flange or thickening in this region (generally as in Figs 47, 49, but more pronounced in some New Caledonian *O. sarasini* specimens) 18
- 18(17). *a* Head, thorax and nodes almost entirely covered by fine raised-reticulate microsculpture which overlies the basic foveate macrosculpture; foveae distinct on head but obscure and usually with elaborate outlines (Fig. 29) over much of thorax and nodes; gastral dorsum obscurely reflective, bearing finely incised micro-reticulate sculpture. E. Qld, NE. N.S.W. *O. mjobergi* Forel
- b* Head, thorax and nodes carrying numerous spaced circular foveae of simple outline; the intervening surfaces smooth, shining and lacking clearly defined microsculpture, though faint traces may be present (Figs 30, 36); gastral dorsum smooth and highly reflective 19
- 19(18). *a* Head relatively narrow (CI 67–69); lamellae lining inner borders of mandibular shafts only very slightly expanded just basad of the apical teeth (Fig. 35); postpetiole distinctly longer than wide (Fig. 36). NE. Qld. *O. darlingtoni*, sp. nov.
- b* Head relatively broad (CI 75–80); lamellae of inner mandibular borders distinctly expanded just basad of apical teeth; postpetiole at most only slightly longer than wide (Fig. 49) 20
- 20(19). *a* Size larger, HL (max.) > 1.30 mm; pronotal teeth small, acute (Fig. 30); anterior mesonotal tubercles poorly developed (Fig. 50). SE. Aust., North I. N.Z. *O. antennatus* Fr. Smith
- b* Size smaller, HL (max.) < 1.30 mm; pronotal teeth about twice as large as shown in Fig. 30, usually less acute; anterior mesonotal tubercles well developed. New Caledonia. *O. sarasini* Emery
- 21(1). *a* Dorsal profile of thorax more or less evenly arched (Fig. 37); body and appendages opaque, entirely covered by fine, almost velvety microsculpture; in addition head, thorax and waist nodes with macrosculpture of scattered elaborate foveae which vary in density and intensity (Figs 37–42) *O. velutinus*, sp. nov.
- b* Thoracic profile stepped or sinuous, with the promesonotal dorsum arched and raised above the propodeum (Figs 2, 4); body and appendages basically smooth and shining, lacking formal microsculpture; sometimes with scattered foveate macrosculpture, notably on the head, especially ventrally 22
- 22(21). *a* Occipital lobes rounded or bluntly angulate, not drawn out into acute teeth or spines (Figs 1, 2) 23
- b* Each occipital lobe drawn out into a long, dorsally curved, tapered spine (Figs 3, 4) *O. horvathi* Szabó

- 23(22). *a* Propodeal spines and petiole long, but not extremely so, about $\frac{2}{3}$ as long as the greatest width of the gaster; colour yellow, with blackish or dark reddish brown thorax and nodes.....*O. chyeri* Emery
b Propodeal spines and petiole extremely long, about as long as gaster is wide; colour not as above, usually concolorous yellow or with the head and thorax darker than the gaster.....24
- 24(23). *a* As seen in direct frontal view of head the occipital lobes each terminating in a blunted angle (Fig. 1).....25
b As seen in direct frontal view the occipital lobes each ending in an evenly rounded full curve (Brown 1957, figs 1, 2).....*O. szentiaanyi* (Brown)
- 25(24). *a* Head and alitrunk brownish red, gaster yellow.....*O. biroi* Szabó
b Head and alitrunk predominantly black or piceous, gaster brownish yellow.....*O. longispinosus* Donisthorpe

Descriptions of New Species

Almost all the micrographs illustrating this paper depict holotype specimens, the preparation of which required their coating with a thin film of gold-palladium alloy. This obscures the colour and patterns of the specimens, a disadvantage outweighed by the advantages gained through production of the micrographs. Where paratypes were available the one best matching its uncoated holotypes has been selected and mounted with that holotype to indicate the obscured coloration. If desired, the alloy coating can be partly removed by touching the coated specimens against the surface of a pool of metallic mercury.

Orectognathus elegantulus, sp. nov.

(Figs 11–13)

Type locality. **Queensland:** Lamington National Park (at c. 28°14'S., 153°08'E.).

Material examined. (1) Holotype and 5 paratype workers, type locality, at night on tree trunk in primary rain forest, near O'Reillys Guest House, c. 920 m, 21.iii.1973, R. W. Taylor and R. J. Kohout. (2) Paratype dealate female with 2 paratype workers: **New South Wales:** Dorrigo National Park (at c. 30°23'S., 152°44'E.), ex rotting log, rain forest, c. 700 m, 6.i.1975, P. Ward.

Type deposition. Holotype, two paratype workers, paratype female in ANIC (type No. 5704); one paratype worker each in AM, BM(NH), GM, MCZ, QM.

Worker Diagnosis

Dimensions. (Holotype, 5 Lamington paratypes, 2 Dorrigo paratypes): TL c. 4.1, 4.2–4.6, 4.3–4.6; HL (max.) 1.04, 1.09–1.18, 1.06–1.16; HL (mid) 0.85, 0.87–0.93, 0.85–0.90; HW 0.85, 0.89–1.00, 0.87–0.96; CI 82, 82–85, 82–83; SL 0.72, 0.73–0.80, 0.74–0.77; SI 85, 80–82, 80–85; ML 0.62, 0.64–0.67, 0.62–0.66; MI 60, 57–59, 57–58; ThL 1.16, 1.12–1.34, 1.17–1.29; PL 0.46, 0.47–0.50, 0.46–0.50. Distribution of index values suggests that HW is positively, ML negatively, allometric relative to HL.

Major diagnostic features as in Figs 11–13 and appropriate sections of key couplets 1*a*, 2*a*, 3*a* and 4*b*.

Head golden brown; thorax, petiole and postpetiole largely dark mahogany brown, propodeum and mesepisterna darkest, shading to lighter areas on promesonotal dorsum, humeral spines, apices of propodeal spines and crests of petiolar and postpetiolar nodes, all of which nearly match the head colour. Gaster clear golden brown; base obscurely infuscated ventrally; first tergite with a diffusely outlined

darker, reddish brown median patch (about as large as postpetiolar dorsum), and less distinct lateral patches, producing a gastral pattern reminiscent of some *Colobostruma* species.

There is, apparently, no significant variation among the specimens.

Female Diagnosis

The single known female, from the Dorrigo series, differs from the workers in the usual characters and has the following dimensions:

TL c. 5.7; HL (max.) 1.25; HL (mid) 0.97; HW 1.08; CI 87; SL 0.85; SI 79; ML 0.70; MI 56; ThL 1.60; PI 0.63.

O. elegantulus resembles *O. nigriventris*, but differs in the following features (cf. Figs 11–13 with Mercovich (1958), fig. 1): (1) colour: *O. nigriventris* is uniformly more reddish golden brown with the gaster dark brown, sometimes nearly black; (2) proportions of cephalic and thoracic armament: preocular, humeral, mesonotal and propodeal spines considerably shorter and less acute in *elegantulus*; anterior mesonotal welts less developed; (3) dorsolateral teeth lacking on petiolar node of *elegantulus*.

Relationships

This species is sufficiently like *O. nigriventris* (Mercovich 1958, figs), and its probable near relative *O. phyllobates* (Brown 1957, figs), to imply its relationship to them. *O. elegantulus* also somewhat resembles *O. sexspinosus* (Figs 5, 6) and could link that rather aberrant species back to *nigriventris*-like stock. I unite these four species in the group of *O. sexspinosus*, and consider *O. nigriventris* to be perhaps the most conservative species of *Orectognathus*.

The *sexspinosus* group relates fairly easily to: (1) the *O. versicolor* group (*clarki* and *versicolor*) and (2) the New Guinean *O. czikii* group (*czikii* and *echinus*). Direct comparison shows *nigriventris* and *clarki* (Figs 9, 10) to be quite similar in general habitus, exclusive of differences in sculpture, and the dimensions and deployment of the various spines and denticles of the head, thorax and petiole. Close relationship between *clarki* and the dimorphic *versicolor* seems assured when their very similar (minor) workers are compared (cf. Figs 9 and 10 with Figs 43 and 44). *O. czikii* differs somewhat from *nigriventris* in promesonotal structure, and has paired median cephalic denticles. However, the two species are otherwise generally similar. The very bizarre *O. echinus* seems essentially to be an 'attenuated' version of *czikii* and, considered in this light, it can be plausibly derived from *nigriventris*-like stock through a *czikii*-like ancestor [see illustrations in Taylor and Lowery (1972)].

Notes

The *elegantulus* types were collected foraging at times between two and five hours after sunset. *O. antennatus* and *O. versicolor* were taken at the same time.

Nocturnal–crepuscular foraging seems prevalent in *Orectognathus*. It was reported for *clarki*, *sarasini* and *phyllobates* by Brown (1957), and I have observed it in *antennatus* (both in Australia and New Zealand), *elegantulus*, *clarki*, *howensis*, *mjobergi*, *parvispinus* and *versicolor*. I have taken *namus* and *phyllobates* abroad in daylight, but only in dull, overcast or showery weather.

Orectognathus robustus, sp. nov.

(Figs 14–16)

Type locality. **Queensland:** Lake Eacham National Park (17°17'S., 145°37'E.), near Yungaburra.

Type specimens. Type designation is specifically restricted to specimens collected at the type locality, or nearby on the surrounding Atherton Tableland, as follows: **Queensland:** type locality, holotype and 46 nidoparatype workers, 1 nidoparatype female, c. 760 m, 17–18.vii.1971, R. W. Taylor and J. E. Feehan; paratype workers and females as follows: worker, 7.vi.1962, R. W. and W. Taylor; female, 1–7.x.1972, R. W. Taylor; female, 2 workers, 21.iii.1975, R. W. Taylor. 13.3 km N. of Kuranda (on Black Mt Road), paratype worker, c. 1500 ft, 3.i.1971, J. G. Brooks. Crater National Park, paratype female, 11.i.1971, J. G. Brooks. c. 12 km SE. of Millaa Millaa, 2 paratype workers, c. 600 m, 5.vii.1971, R. W. Taylor and J. E. Feehan.

The type colony was taken nesting in a small fragment of rotting wood on the floor of primary rain forest. Other specimens are from Berlese funnel samples of rain forest leafmould.

Type deposition. Holotype and most paratypes, including females, in ANIC (type No. 7507); worker nidoparatypes in BM(NH), GM, MCZ, QM, SAM.

Worker Diagnosis

Dimensions. [Holotype, nidoparatype series, smallest known worker (Lake Eacham, 7.vi.62)]: TL c. 4.1, 3.8–4.2, 3.7; HL (max.) 1.03, 0.95–1.05, 0.91; HL (mid) 0.74, 0.70–0.77, 0.68; HW 0.80, 0.75–0.84, 0.72; CI 78, 78–81, 79; SL 0.71, 0.68–0.72, 0.67; SI 88, 86–91, 93; ML 0.64, 0.61–0.65, 0.60; MI 62, 61–65, 66; ThL 1.10, 1.02–1.15, 0.97; PL 0.46, 0.43–0.48, 0.40.

General features as in Figs 14–16. Major diagnostic characters as in relevant sections of key couplets 1a, 2a, 3b, 5a and 6a.

Colour overall medium reddish brown, mandibles, antennae, crests of occipital lobes, thoracic spines and gaster a shade lighter. Legs pale yellowish brown, in parts almost white, coxae and femoral knees darker. Further characterization of this distinctive species is unnecessary.

The types show no apparently significant variation in salient features, including those reviewed below in discussing provisionally identified specimens from other localities. There is no evident allometric variation in development of the thoracic spines, such as is seen so markedly in the related *O. parvispinus*, described below.

Female Diagnosis

The nidoparatype and three paratype females listed above differ from the workers in the usual characters. The smallest and largest specimens, both from Lake Eacham (dated 1–7.x.1972 and 21.iii.1975 respectively), have the following dimensions:

TL c. 4.4, 4.5; HL (max.) 1.00, 1.06; HL (mid) 0.75, 0.79; HW 0.81, 0.86; CI 81, 81; SL 0.70, 0.72; SI 86, 84; ML 0.60, 0.62; MI 60, 58; ThL 1.20, 1.30; PL 0.47, 0.50.

Material Provisionally Assigned to O. robustus

The series listed here are provisionally identified as *O. robustus*. Three consistent forms are represented. These could be geographical or other variants of *robustus* itself, separate similar allopatric species, or a combination of both. Most specimens

have been retained in the ANIC, labelled as vouchers, in order to keep the series intact for future study. Some are deposited in the MCZ.

Collection details: **Queensland:** *Iron Range* (12°45'S., 143°13'E.), 7 workers in two samples, 14.vi.1971, R. W. Taylor and J. E. Feehan. *Thornton Range* (16°14'S., 145°26'E.), 15 workers, alate female and male, c. 100 m, 23.iv.1971, R. W. Taylor and J. E. Feehan. *Near Kenilworth*, (at c. 20°36'S., 152°43'E.), worker, dealate female collected separately, c. 150 m, 17.iii.1973, R. W. Taylor; *Kenilworth*, 7 workers, alate female, dealate female, male, May 1958, P. F. Darlington; *Toowoomba*, 4 workers, Jan. 1942, T. Greaves. All samples except that from Toowoomba are labelled 'rain forest'; the Taylor or Taylor and Feehan collections are from leafmould Berlese funnel samples.

Dimensions of these series are summarized in Table 1.

Table 1. Measurements and indices of forms of *Orectognathus* discussed in the text under *O. robustus*. Values are the ranges of dimensions with means in parentheses. Unit of measurement, 0.01 mm. The *O. robustus* paratypes are from the Atherton Tableland in north Queensland; Thornton Range and Iron Range are also in north Queensland; Kenilworth and Toowoomba are in south-east Queensland

Dimension	<i>O. robustus</i> paratypes	Thornton Range	Iron Range	Kenilworth	Toowoomba
HL (max.)	91-105 (99)	89-95 (93)	85-94 (90)	89-98 (94)	94-104 (97)
HL (mid)	68-77 (73)	66-70 (69)	65-69 (67)	68-74 (71)	73-78 (76)
HW	72-84 (79)	73-79 (75)	73-80 (77)	74-83 (79)	80-87 (82)
CI	78-81 (80)	78-85 (81)	83-88 (85)	83-85 (84)	84-86 (85)
SL	67-72 (69)	65-70 (68)	61-65 (64)	65-74 (70)	68-73 (70)
SI	86-93 (88)	81-95 (91)	81-86 (83)	87-90 (89)	84-86 (85)
ML	60-65 (63)	61-65 (63)	56-60 (58)	62-68 (65)	64-68 (65)
MI	61-66 (64)	67-70 (69)	63-66 (64)	68-71 (69)	65-68 (67)
ThL	97-115	94-99	91-97	96-108	105-111
PL	40-48	38-42	42-45	38-46	44-50
No. of specimens	17	12	12	7	4

The Thornton Range site is about 120 km to the north of Lake Eacham, at a much lower elevation, though within the main base-of-peninsula rain-forest area (Taylor 1972). Thornton workers generally resemble the *robustus* types in structure and colour, but the sculptural foveae of the thoracic dorsum and petiole are reduced in number by about half, and are correspondingly more scattered. The central pronotal disc and a narrow median strip on the mesonotal and propodeal dorsa generally lack foveae. The postpetiolar dorsum, which bears numerous small foveae in the *robustus* types, is generally smooth, carrying only effaced traces of such sculpture. Table 1 shows that Thornton workers average smaller in most dimensions than the *robustus* paratypes, with similar values for CI, and higher for SI and MI. However, the Lake Eacham paratype dated 7.vi.1962 is relatively small, and when compared with a Thornton specimen with the same HL (max.) measurement (Table 2) the two are essentially identical in other measurements and proportions. Taxonomic significance of the observed sculptural variation cannot be estimated on the basis of so few available specimens and series.

The Iron Range specimens are from the separate major mid-peninsula rain-forest area, at a site about 560 km to the north of Lake Eacham. They are from two leaf-mould berlesates collected contiguously in low-elevation riverine rain forest. In this

form the petiole and postpetiole are consistently bulkier and the sculpture slightly more dense than in the *robustus* types. Most dimensions average smaller even than in the Thornton Range workers, with CI higher than either base-of-peninsula form, SI lower, and MI about as in the *robustus* types. Moreover, the two specimens cited in Table 2 have very high CI, and low SI and MI values compared with equivalent specimens from other series. It is not possible now to determine the taxonomic status of the Iron Range specimens satisfactorily, hence their provisional identification, pending accumulation of further relevant material.

Table 2. Measurements and indices of selected specimens of forms of *Orectognathus* discussed under *O. robustus*

Two specimens from Iron Range; one each from other localities. Unit of measurement, 0.01 mm. All specimens have maximum head length 0.91–0.92 mm

Dimension	<i>O. robustus</i> paratype	Thornton Range	Iron Range	Iron Range	Kenilworth
HL (max.)	91	91	91	91	92
HL (mid)	68	68	67	68	69
HW	72	74	80	78	78
CI	79	81	88	86	85
SL	67	68	65	64	68
SI	93	92	81	82	87
ML	60	62	59	58	65
MI	66	68	65	64	71
ThL	97	95	96	95	99
PL	40	40	44	43	42

The south-east Queensland specimens from Kenilworth district and Toowoomba were taken at distances between 1200 and 1300 km south from Lake Eacham. They conform to a single morph, with the following features: Humeral and propodeal spines about $\frac{2}{3}$ as long as in northern samples. Other general details of form as illustrated by the *robustus* holotype (Figs 14–16). Thoracic sculpture much as in the Thornton Range series, but with the cephalic foveae slightly but distinctly smaller and less densely packed. Colour very different. Head and thorax generally dark mahogany brown, shading to reddish brown on clypeus, occipital lobes, apices of frontal lobes and preocular denticles, pronotal collar, humeral and propodeal spines, and metapleural lobes. Petiole dark reddish brown, postpetiole less darkly so. Gaster rich golden brown. Mandibles, antennae and legs light to medium yellowish brown. The ranges and means of measurements and indices of the Kenilworth and Toowoomba workers differ somewhat (Table 1). However, only 11 specimens are involved, and these are probably from only one colony at each locality. In view of this the differences need not be accorded taxonomic significance. A Kenilworth specimen with HL (max.) of 0.92 mm is itemized in Table 2 for comparison with similar-sized specimens from elsewhere.

The single female specimen from Thornton Range and the two (one alate) from Kenilworth differ from the *robustus* paratype females in sculpture and colour exactly as would be expected considering the worker differences reviewed above. They have the following dimensions, stated in the order: Thornton; Kenilworth dealate, Kenilworth alate:

HL (max.) 0.97; 0.98, 1.00. HL (mid) 0.73; 0.75, 0.78. HW 0.81; 0.84, 0.86. CI 83; 86, 86. SL 0.70; 0.70, 0.72. SI 86; 83, 84. ML 0.65; 0.65, 0.67. MI 67; 66, 67. ThL 1.20; 1.25, 1.22. PL 0.45; 0.46, 0.48.

I am inclined to consider the Iron Range and south-east Queensland series as representatives of two species separate from *O. robustus*, and the Thornton Range form as an elevational or geographical variant of *robustus*. Elucidation of the relative status of 'true' (Atherton Tableland) *robustus* and the Thornton Range form should follow readily as collections improve. If these prove to be separate biological species, the Iron Range and southern forms could logically be considered good species.

Relationships

Orectognathus robustus is doubtless closely related to the very similar *O. parvispinus*, described below (Figs 17–19). These species relate in turn to the nearly identical pair *O. rostratus* and *O. nanus* (Figs 20–23). The last two are distinctive by virtue of their bizarre cephalic, ocular and mandibular configuration, but they have post-cephalic structure very like that of *robustus*. The thoracic and petiolar structure of these four species sets them apart in their genus as the group of *O. rostratus*. The thorax is much less complex than in other *Orectognathus* species (excluding the *O. chyzeri* group) in that the posterior part of the promesonotal dorsum is not inflated and armed with spines or denticles as is usual in Australian members of the genus. This represents an extreme condition which could be interpreted either as primitive or derived. I consider it to be derived, for the following reasons: (1) It can be reasonably assumed that the earliest dacetines had complex thoracic spination, and that the various groups with reduced spination are derived (Brown and Wilson 1959). The *robustus* group seems no exception. (2) The flat or concave transverse anterior portion of the pronotal dorsum (above the steep slope to its anterior collar), and the relationships between its surface and the dorsal faces of the humeral spines (well illustrated in the *O. parvispinus* figures), could represent the last vestiges of pronotal form derived from an ancestor with promesonotal structure like that of *O. phyllobates* or *O. elegantulus* (Figs 11–13). If this is accepted, the derivation of a *rostratus*-like thorax from an *elegantulus*-like structure would present little difficulty. It could be accomplished through contraction of the raised promesonotum, with loss of its denticles, and consequent simplification of the dorsal thoracic outline. In this regard the *O. nanus* thoracic profile could be considered to represent a derived state compared with that of *O. robustus*, since the promesonotal and propodeal outlines are separated by an indentation, rather than forming a single convexity (cf. Figs 14, 20).

The species of the *O. rostratus* group superficially resemble members of the Australian dacetine genus *Epopostruma* Forel, especially in thoracic structure. I consider this resemblance due to convergence. *Epopostruma* differs from *rostratus* and its relatives in several significant features, including the following:

- (1) Antennae six-segmented, versus five-segmented.
- (2) Apical mandibular fork including two teeth, versus three.
- (3) Antennal scrobes in *Epopostruma* ventrally placed, so that the scapes at repose lie below the eyes; in *Orectognathus* the scrobes are situated above the eyes, and there receive the scapes (Figs 15, 35).

- (4) Antecular denticles absent, versus present (though vestigial in some *O. rostratus* specimens, and lacking in species of some other groups in *Orectognathus*).
- (5) Petiolar node with a pair of usually distinct dorsolateral teeth or spines, which are lacking in the *rostratus* group, though present in some other *Orectognathus* species.
- (6) Postpetiole usually with distinct, though sometimes reduced or vestigial, lateral spines, ridges or low horizontal alary plates. Structures of this sort are lacking in all *Orectognathus* species.

The interesting African dacetine genus *Microdaceton* Santschi has been associated with *Epopostruma* in the long-mandibulate section of subtribe Epopostrumiti (Taylor 1973; and references). It is notable that this genus resembles *Orectognathus* in the presence of three apical mandibular teeth, and in carrying its antennal scapes above the eyes, though scrobes are not developed. *Microdaceton* has six-segmented antennae like *Epopostruma*. Its thorax and petiole are distinctive, though markedly more *Orectognathus*- than *Epopostruma*-like, and its postpetiolar structure is decidedly *Epopostruma*-like.

Microdaceton emerges as somewhat intermediate in character between the two Australian genera. This does not suggest that it should be synonymized, along with *Epopostruma*, under *Orectognathus*. It does, however, challenge the status of the subtribe Epopostrumiti as a taxon separate from *Orectognathiti*. Alternatively, *Microdaceton* might be considered so close to *Orectognathus* as to justify its transfer to subtribe *Orectognathiti*, leaving the Epopostrumiti as an intact though somewhat depleted subtribe. A decision on these matters is beyond the scope of the present paper.

***Orectognathus parvispinus*, sp. nov.**

(Figs 17–19)

Type locality. Queensland: Eungella National Park, c. 3 km S. of Eungella (28°21'S., 153°19'E.).

Material examined. Holotype, 14 paratype workers, 2 paratype dealate females, from type locality. All were collected by the author from sites less than 200 m apart in primary rain forest at elevation c. 780 m. All except the holotype are from Berlese funnel samples of leafmould, in three separate series dated 26.iii.1975 (2 series), and 12.ix.1975. The holotype was straying on the ground at night (2.v.1973).

Type deposition. Holotype and most paratypes, including females, in ANIC (type No. 7508); worker paratypes in BM(NH), GM, MCZ, QM, SAM.

Worker Diagnosis

Dimensions (holotype cited first). TL c. 4·3, 3·8–4·5; HL (max.) 1·04, 0·96–1·10; HL (mid) 0·79, 0·71–0·84; HW 0·85, 0·73–0·89; CI 82, 76–82; SL 0·80, 0·75–0·83; SI 95, 93–100; ML 0·70, 0·67–0·75; MI 67, 67–71; ThL 1·08, 0·98–1·20; PL 0·46, 0·38–0·49.

General features as in Figs 17–19 and appropriate sections of key couples 1a, 2a, 3b, 5a and 6b. Similar to *O. robustus*, but differing from it in the following salient features:

- (1) Propodeal spines much less developed and showing considerable allometric variation in size. Maximum spine development (in the largest available specimen, with HW 0·89 mm) slightly greater than that shown in Fig. 17,

which illustrates the approximate condition of most specimens in the size range HW 0.82–0.86 mm. The smallest available specimen (HW 0.73 mm), with vestigial spines, represented as slightly raised longitudinal ridges flanking the gently sloping propodeal declivity. The crest of each ridge rises to form an angle of about 90° in side view, producing a profile much as would be shown in Fig. 17 if the propodeal spine were deleted by continuing the line of the thoracic dorsum until it meets the profile of the propodeal declivity (or, more correctly, of the near-side ridge subtending the propodeal spine). There is clear gradation from this minimum condition to that of Fig. 17, through a series of specimens with HW 0.75–0.81 mm, the allometric progression appearing not to be continuous throughout the whole type series, but more or less concentrated in the lower third to half of the full size range.

- (2) Sculptural foveae of head about as in the *robustus* types, but averaging slightly larger in size. Foveae of thoracic dorsum much less densely sown, especially on the transverse, depressed anterior part of the pronotal dorsum and the dorsa of the humeral spines. Sides of thorax, petiole and postpetiole less strongly sculptured. The sculpture of *parvispinus* is, in fact, not unlike that of the Thornton range ants provisionally identified above as *O. robustus*.
- (3) Other minor features of proportions, especially of the thorax and nodes, as illustrated. The petiolar node, particularly, varies allometrically, being proportionately more slender in smaller specimens.

Several specimens, which might not be fully pigmented, are coloured like the *robustus* types. Most, however, have coloration generally slightly lighter, but otherwise like that of the south-eastern Queensland specimens provisionally identified above as *O. robustus*.

Female Diagnosis

The two paratype females have the following dimensions:

HL (max.) 1.08, 1.15; HL (mid) 0.82, 0.83; HW 0.89, 0.92; Cl 82, 80; SL 0.80, 0.83; SI 90, 90; ML 0.70, 0.73; MI 65, 64; ThL 1.34, 1.40; PL 0.53, 0.55.

They differ from the workers in the usual details, and, predictably, from the *robustus* female paratypes, in having shorter propodeal spines, less dense thoracic foveolation and a less pronounced nodal thickening of the petiole.

Relationships

O. parvispinus is almost certainly a close relative of *O. robustus*, and probably evolved from *robustus*-like stock. Its type locality is in the biogeographically important large island of montane rain forest on Eungella Range, west of Mackay. This area is well isolated from other large tracts of similar forest. Northwards, about 250 km separate it from the forests of Mt Elliot (19°30'S., 146°59'E.) near Townsville. The first major forests to the south are on Dawes Range, at Bulburin State Forest [= Mt Jacob of Darlington (1960)] near Many Peaks (24°32'S., 151°23'E.), almost 480 km away. The most southern *O. robustus* collection site in north Queensland is about 530 km to the north of Eungella, and the nearest records of the south-eastern variant, or sibling relative, of *robustus* were made about 750 km southwards. *O. parvispinus* is sympatrically associated in rain forest at Eungella with at least two other *Orectognathus* species: (1) *O. versicolor*, which ranges south into north-east

New South Wales, but which is not known to occur further north than at Eungella; (2) *O. mjobergi*, which ranges from north-east New South Wales to the Atherton Tableland of north Queensland.

Orectognathus nanus, sp. nov.

(Figs 20–22)

Type locality. **Queensland:** *Seymour Range*, c. 5 km N. of Innisfail (17°32'S., 146°02'E.).

Material examined. **Queensland:** *Kuranda*, Black Mountain Road, worker, berlesate, 350 m, 27.vi.1971, R. W. Taylor and J. E. Feehan. *Lake Eacham National Park*, worker, berlesate, 760 m, 20.ii.1973, RWT. *Seymour Range*, holotype worker, 5 nidoparatype workers, 10 nidoparatype females (1 dealate, 9 alate), nidoparatype male, ex rotting log, c. 40 m, 3–4.xi.1966, RWT. *Crawford's Lookout*, female, berlesate, 320 m, 5.vii.1971, RWT and JEF. *Tully Falls National Park*, worker, berlesate; worker, female, ex small rotting wood fragment, c. 750 m, 2.vii.1971, RWT and JEF. *McNamee Creek* (c. 10–14 km W. of Paronella Park), female, ex small rotting wood fragment, 600 m; 2 workers, 2 females, ex rotting wood fragments, 400 m, 6.vii.1971, RWT and JEF. *Cardwell Range*, near Alma Gap (c. 12 km W. of Kennedy), worker, stray on log, overcast late afternoon, c. 610 m, 26.vi.1962, RWT. All collections from rain forest. Specimens other than type colony series (nidoparatypes) are designated as paratypes.

Type deposition. Holotype and most secondary types in ANIC (type No. 7509); paratype or nidoparatype workers in BM(NH), GM, MCZ, QM.

Worker Diagnosis

Dimensions (holotype cited first). TL c. 2.1; 2.8–3.5; HL (max.) 0.67, 0.64–0.74; HL (mid) 0.58, 0.54–0.62; HW 0.58, 0.55–0.65; CI 87, 86–88; SL 0.49, 0.48–0.54; SI 84, 83–87; ML 0.36, 0.37–0.43; MI 58, 57–59; ThL 0.85, 0.77–0.95; PL 0.39, 0.34–0.43. Distribution of index values suggests that HW is slightly positively allometric relative to HL, while SL is slightly negatively allometric; ML seems to be essentially isometric to HL.

Major diagnostic features as in Figs 20–22, and appropriate sections of key couplets 1a, 2a, 3b, 5b and 7b. Very similar to *O. rostratus*, differing from it mainly in sculptural characters, the details of which are compared in key couplet 7 above, and in Figs 21 and 23. Colour almost uniformly light golden brown; mandibles, antennae, frontal lobes, legs, apices of humeral and propodeal spines, and gaster a shade lighter.

Female Diagnosis

The nidoparatype and paratype females listed above differ from the workers in the usual characters, and from females of *O. rostratus* in sculptural features exactly paralleling those of the workers. The smallest (McNamee Creek) and largest (Seymour Range) available specimens have the following dimensions:

TL c. 3.7, 3.8; HL (max.) 0.76, 0.77; HL (mid) 0.65, 0.65; HW 0.66, 0.68; CI 87, 88; SL 0.53, 0.54; SI 80, 79; ML 0.42, 0.42; MI 55, 55; ThL 1.04, 1.06; PL 0.45, 0.45.

Relationships

O. nanus is clearly related to *O. rostratus*. As usual with closely similar but apparently allopatric organisms, it is possible that they are geographical variants

of a single biological species. The differences between them are, however, very consistent, and I have concluded that they are most likely to be separate species. The case parallels that of *O. phyllobates* and *O. nigriventris*. *O. nanus* and *O. rostratus* are distinctive in *Orectognathus* by their bizarre cephalic and mandibular structure, shown in Fig. 21. However, their thoracic and petiolar structure is closely similar to the condition in *O. robustus* and *O. parvispinus*. This allows these four species to be associated in a single group, that of *O. rostratus* (see discussion above under *O. robustus*).

Orectognathus roomi, sp. nov.

(Figs 24–27)

Type locality. Papua New Guinea: near Kokoda (8°53'S., 147°44'E.), Northern District.

Material Examined. Known only from the unique holotype worker, collected on the ground, primary midmontane rain forest, c. 800 m, 1.v.1972, P. M. Room. The specimen has been gold-palladium coated.

Type deposition. In ANIC (type No. 7510).

Worker Diagnosis

Dimensions. TL c. 6·8; HL (max.) 1·58; HL (mid) 1·18; HW 1·12; CI 71; SL 1·31; SI 83; ML 1·62; MI 102; ThL 1·75; PL 0·91.

Major diagnostic features as in the appropriate sections of key couplets 1a, 2b, 8b, 10a, 11b and 12a. Colour golden yellowish brown.

Very similar to *O. hystrix* (cf. Figs 24–27 with Taylor and Lowery (1972), fig. 28, pl. 1). The two species are clearly closely related, but there are major differences in sculpturation (Figs 27 and 28), and proportions. Compared with the 16 known *hystrix* specimens the *roomi* holotype has a proportionately narrow head and shorter scapes (*hystrix* has CI 75–82; SI 94–100).

Further characterization is unnecessary.

Notes

The occipital spines of *roomi* are placed not quite as far forward on the occipital lobes as are those of *hystrix*. Their configuration could represent a condition intermediate between that of *hystrix* and that represented by *O. horvathi* (Figs 3, 4), where the spines resemble horns drawn out from the apices of the occipital lobes. The derivation of *hystrix*-like spines could have occurred through stages like those reflected in the morphocline *darlingtoni* → *satan* → *horvathi* → *roomi* → *hystrix* (see Figs). This does not imply actual close relationship between the species listed. In fact, *roomi* and *hystrix* stand well apart in *Orectognathus*, though they can reasonably be linked back to more conservative species, like those of the *nigriventris* group, through stock similar to *O. csikii*. The microsculpture of *roomi* appears to be a derived character. Similar microsculpture has presumably evolved quite separately in both *O. mjobergi* and *O. velutinus* (see below).

Orectognathus darlingtoni, sp. nov.

(Figs 31–36)

Type locality. Queensland: Lake Eacham National Park (17°18'S., 145°37'E.), near Yungaburra.

This species is named for Professor P. J. Darlington, Jr., of Harvard University.

Material examined. Known only from three neighbouring localities on the Atherton Tableland, **Queensland**: *Lake Eacham National Park*, holotype, 30 nidoparatype workers, nidoparatype female, c. 760 m, 17–18.vii.1971, R. W. Taylor and J. E. Feehan; *3.2 km E. of Lake Barrine*, paratype female, c. 720 m, 1.vii.1971, R. W. Taylor and J. E. Feehan; *1.6 km S. of Yungaburra* (Curtain Fig Scrub) 10 paratype workers, female, c. 720 m, 7.ix.1975, R. W. Taylor. The Eacham and Barrine collections are from small rotting wood fragments, and the Curtain Fig sample from a large red-rotten log lying on the ground in rain forest.

Type deposition. Holotype and most paratypes (including females) in ANIC (type No. 7517); worker paratypes in BM(NH), GM, MCZ, HNM, QM, MNB, Paris Museum, SAM. Several larvae from type colony in ANIC.

Worker Diagnosis

Dimensions (holotype cited first): TL c. 6.4, 5.9–6.8; HL (max.) 1.42, 1.34–1.53; HL (mid) 1.13, 1.08–1.16; HW 0.97, 0.91–1.04; CI 68, 67–69; SL 1.00, 0.97–1.05; SI 103, 101–108; ML 0.90, 0.88–0.94; MI 63, 61–65; ThL 1.76, 1.60–1.82; PL 0.75, 0.68–0.78.

General features as in Figs 34–36, and in appropriate sections of key couplets 1a, 2b, 8b, 10b, 13b, 17b, 18b and 19a.

Similar to *O. antennatus*, but with the head distinctly narrower (CI 75–80 in *antennatus*) and the distal expansions of the inner mandibular lamellae less pronounced (cf. Figs 35 and 49). The sculptural foveae are less densely sown (cf. Figs 30 and 36), and the intervening surfaces highly polished, where in *antennatus* they are slightly dulled by an indistinct rippling of the cuticle (these details in *antennatus* especially noticeable on occipital lobes and thoracic dorsum, particularly the propodeum, sides of pronotum and lower mesepisternum). The metanotal and propodeal spines are a little longer than in *antennatus*, and the petiole, like the post-petiole, is very distinctly longer.

Female Diagnosis

The nidoparatype and paratype females have the following dimensions:

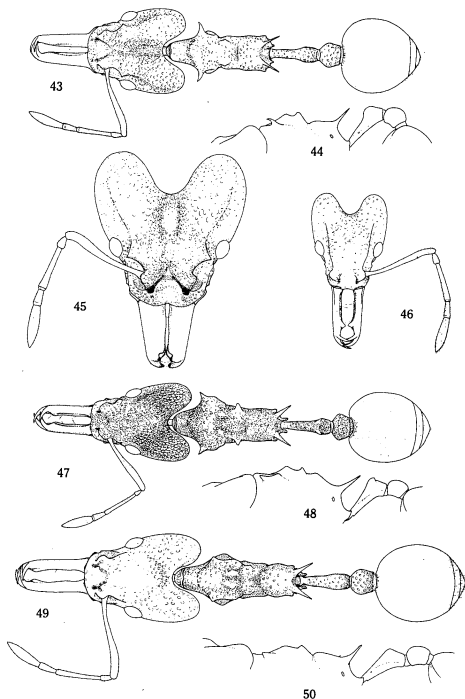
HL (max.) 1.48, 1.49; ML (mid) 1.16, 1.16; HW 1.04, 1.04; CI 70, 70; SL 0.99, 0.98; SI 95, 94; ML 0.92, 0.92; MI 62, 62; ThL 1.94, 1.92; PL 0.74, 0.76.

These specimens differ from the workers in the usual features, and from females of *O. antennatus*, predictably, in having narrower heads, less expanded mandibular lamellae, reduced sculpture, and more elongate propodeal spines and waist segments.

Chromosomes

O. darlingtoni is distinguished as the first ant species ever to have details of its chromosome structure published with its original taxonomic diagnosis. The Curtain Fig Scrub colony was transported live after collection to the Sydney laboratory of Dr R. H. Crozier, where chromosomal smears of worker and male brain cells were prepared and analysed by the visiting Japanese geneticist Dr H. T. Imai. Details will be presented elsewhere, but Dr Imai has generously provided several micrographs for publication here as Figs 31–33.

O. darlingtoni has a haploid number of $n = 11$, diploid of $n = 22$, comprising 11 pairs of metacentric to submetacentric chromosomes; which range in size without



Figs 43-50. Standard views of *Orectognathus* workers: 43-45, *O. versicolor*, Lamington National Park, Qld: 43, 44, minor (HW 1.15 mm); 45, major (HW 2.06 mm); 46, *O. howensis*, Erskine valley, Lord Howe I. (HW 0.98 mm); 47, 48, *O. mjobergi*, syntype (HW 1.12 mm); 49, 50, *O. antennatus*, Lamington National Park, Qld (HW 1.08 mm).

evident major discontinuity. The resulting karyotype is similar to those of several epopostrumite dacetines, *Epopostruma* sp., and *Colobostruma alinodis*, as reported by Crozier (1968), except that *Epopostruma* has $n = 10$, $2n = 20$. In addition, a second, apparently undescribed, *Colobostruma* species [sp. No. 1 (ANIC)] and *Orectognathus versicolor* each, like *O. darlingtoni*, have 11 pairs of metacentric to submetacentric chromosomes (Imai and Crozier, personal communication). The chromosomes of *Orectognathus clarki* were also described by Crozier (1968). This species has $2n = 30$, with a karyotype including nine pairs of metacentric to submetacentric, and six pairs of subacrocentric to acrocentric chromosomes. Taxonomic considerations imply that *O. clarki* and *O. versicolor* are closely related, and that *O. darlingtoni* is not close to them, but relatively distantly related as a considerably more derived species on a separate line of descent within the genus. Further accumulation and study of *Orectognathus* chromosome preparations is obviously to be desired.

Relationships

Close affinity between this species and *O. antennatus* (Figs 49, 50) is very apparent.

The *antennatus* group forms a compact unit within *Orectognathus*, and the addition of *O. darlingtoni*, with its relatively narrow head and long propodeal spines, helps to clarify the position of *O. satan* (Figs 7, 8) as a member of this group. Brown (1953) has commented on the apparent relationship between *antennatus* and *satan*, and suggested also that *satan* might stand close to the stock which gave rise to the *chyzeri* group (then genus *Arnoldidris*). Now that the *O. rostratus* group is known it seems more likely that its members provide the most plausible phenetic links between the *chyzeri* group and more conventional species of *Orectognathus*. The *chyzeri* group could well have evolved from an ancestor resembling *O. robustus* (see discussion below under *O. velutinus*).

The *antennatus* group can, I believe, be derived reasonably from a *nigriventris*-like stock as a lineage in which general elongation and narrowing of the head and thorax has occurred, with early loss of the anteocular denticles, and progressive reduction of the pronotal and mesonotal armament, along with elongation of the propodeal spines, petiole and postpetiole. The culmination of most of these trends is represented by their expression in *O. satan*, which I consider to be the most derivative member of the group. The occipital horns of *satan* are here considered to be secondary specializations, evolved independently of those of *O. horvathi* and other New Guinean species. The relatively strong dorsolateral petiolar teeth of *satan* could represent a secondary development, but might equally be a primitive holdover from ancestral stock. Such spines are probably represented by the vestiges seen in other members of the group. Some apparent evolutionary trends within the *antennatus* group see their ultimate expression in species other than *satan*. Notable are the large preapical expansions to the inner mandibular borders of *O. howensis* (Fig. 46), and the very elongate postpetiole of *O. darlingtoni*.

Brown (1953, 1957) has emphasized that *antennatus*, *sarasini* and *howensis* are so closely similar as to comprise essentially a superspecies, which is central in the *antennatus* group. The remaining species assigned here to the group is *O. mjobergi* (Figs 47, 48), which I consider overall to represent a neat phenetic intermediate between *nigriventris* or *phyllobates*, and *antennatus*. The basal stock of the *antennatus* lineage could well have resembled *O. mjobergi*. If this was the case, the somewhat elaborate sculpturation of *mjobergi* itself (Fig. 29) must be considered the product of several

secondary specializations, namely tendencies towards elaboration of the shape of individual foveae, and the development of microsculpture on the interfoveolar surfaces.

Orectognathus velutinus, sp. nov.

(Figs 37–42)

Type locality. **Papua New Guinea:** *Tagao Rd* (8°46'S., 148°05'E.), c. 17.7 km E. of Popondetta, Northern District.

Material examined. Two workers, designated holotype and paratype. The holotype has been gold-palladium coated. The specimens are mounted on one pin; their coloration was originally nearly identical. These specimens were hand collected straying on leaves on the floor of primary lowland rain forest, in an area destined for clear felling, 10.v.1973, P. M. Room.

Type deposition. In ANIC (type No. 7520).

Worker Diagnosis

Dimensions (holotype cited first). TL c. 5.2, 5.4; HL (max.) 1.26, 1.32; HL (mid) 0.96, 0.98; HW 1.06, 1.14; CI 84, 86; SL 0.75, 0.78; SI 71, 68; ML 0.62, 0.63; MI 49, 48; ThL 1.40, 1.46; PL 0.64, 0.68; width of pronotum in dorsal view 0.64, 0.68; chord length of propodeal spine 1.06, 1.10; length of postpetiole in dorsal view 0.24, 0.26. Head width, as given above, is measured immediately behind and exclusive of the occipital horns.

General features as in key couplets 1b and 21a, and Figs 37–42. Easily distinguished from other known species of the *chyzeri* group by the following characters, most of which are unique to *velutinus*:

- (1) Outer borders of occipital lobes drawn forward as blunt plate-like triangular horns (Figs 37, 39, 40), possibly not directly homologous with those of *O. horvathi* (Figs 3, 4), which are conical and drawn out from the apices of the occipital lobes.
- (2) Postpetiole approximately as broad as long in dorsal view (Fig. 38). The other species of the *chyzeri* group have this segment distinctly longer than broad (Figs 2, 4).
- (3) Body and appendages entirely covered with microsculpture which presents a velvety appearance. Macrosculpture of shallow foveate punctures, each with peculiar microscopically irregular structure (Figs 41, 42), distributed as shown in the accompanying figures; lacking on gaster. Propodeal spines and sides of propodeum with effaced longitudinal rugulae.

(Formal microsculpture is lacking in other *chyzeri*-group species. Macrosculpture, when present, consists of simple, circular foveae, generally restricted to the head, frequently to its underside.)

- (4) Colour pale yellow-brown, with a striking very dark brown transverse stripe crossing the frons; its outline showed as a dotted line in Fig. 39.

Relationships

This elegant species, though very distinctive, can be reasonably assigned to the *chyzeri* group.

The cephalic horns and microsculpture are probably derived characters and resemble the similar conditions, doubtless convergently evolved, in other, apparently distantly related, *Orectognathus* species. The cephalic horns of *O. horvathi* have

probably been derived separately from those of *velutinus*, while those of *O. satan* and the *hystrix*-group species almost certainly represent further separate evolutionary developments. Microsculpture has undoubtedly independently evolved elsewhere, in both *mjobergi* and *roomi*. In addition *mjobergi* has structurally elaborated macrosculptural foveae very like those of *velutinus* (cf. Figs 29 and 41, 42). These must certainly represent an independent development.

If the cephalic horns, microsculpture and extremely enlarged propodeal spines are discounted, *velutinus*, like other *chyzeri*-group species, would resemble the members of the *rostratus* group. It would differ from them primarily in its reduced macrosculpture, and the lack of humeral spines. The *chyzeri* group could in fact logically be derived from a *robustus*-like ancestor through the loss initially of the humeral spines and the anteocular denticles (the latter, incidentally, are often essentially vestigial in *O. rostratus*, and have been lost, presumably convergently, in the *O. antennatus* group).

Several morphoclines [in the sense of Maslin (1953)] represented in species of the *rostratus* and *chyzeri* groups might reflect actual past evolutionary sequences. In this regard: (1) the *horvathi* thoracic profile can be derived from a *robustus*-like structure through the morphocline *nanus* → *biroi* → *horvathi*; (2) the short *robustus*-like petiolar node grades through *parvispinus*- and *velutinus*-like structures to the extremes of *horvathi* and *longispinosus*; (3) derivation of *horvathi*- and perhaps *velutinus*-like occipital horns might be reflected by the morphocline *szentivanyi* → *biroi* → *horvathi* (? and *velutinus*) (possibly with an *O. satan*-like stage following *biroi*); (4) among the *chyzeri*-group species *horvathi* possibly has the least derived sculpturation (i.e. abundant, though relatively small and indistinct, scattered simple foveae, with smooth, shining intervening surfaces). This links back to the more conservative *Orectognathus* condition through *rostratus*- and *robustus*-like configurations. Addition of microsculpture, with coincident elaboration of macrosculptural foveae, is seen on one hand in *velutinus*; while almost total loss of macrosculpture, without apparent development of microsculpture, is seen on the other hand in *biroi*, with *chyzeri* and *szentivanyi* representing intermediate conditions.

Orectognathus comprises a quite remarkable diversity of frequently bizarre ants. Nevertheless a logical set of morphoclines can be derived to rationalize inclusion in the genus of even the most elaborate and eccentric known species, and to imply reasonable grounds on which they may be considered rationally to be interrelated.

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